(12) UK Patent Application (19) GB (11) 2 001 898 A

(21) Application No 7832128
(22) Date of filing
3 Aug 1978
(23) Claims filed
3 Aug 1978
(30) Priority data
(31) 7724432U
(32) 6 Aug 1977
(33) Fed Rep of Germany (DE)
(43) Application published
14 Feb 1979
(51) INT CL² B29F 1/06
(52) Domestic classification
B5A 1R322 2D1X 3D4B 3D4X T14U
(56) Documents cited
GB 1364560
GB 1313680
GB 1225515
GB 1219800
GB 974822
GB 816279
GB 767931
GB 334509
(58) Field of Search
B1C
B5A

(71) Applicant
Bucher-Guyer AG
Maschinenfabrik
CH-8166
Niederweningen
Switzerland
(72) Inventor
EDUARD HARTMANN
(74) Agents
Mewburn Ellis & Co

(54) Screw plasticising machine for processing raw material fed in continuous strip form

(57) The plasticising screw 12 e.g. of an injection moulding machine, has a helical thread whose profile is broad and flat-topped over most of the screw, but narrower and sharper, i.e. triangular, in the inlet zone Ia to aid cutting-in of the strip of material and reduce friction thereby. Friction in the zone Ia may be reduced further, by the height of the crest fluctuating along its length, and the thread being cut deeper.

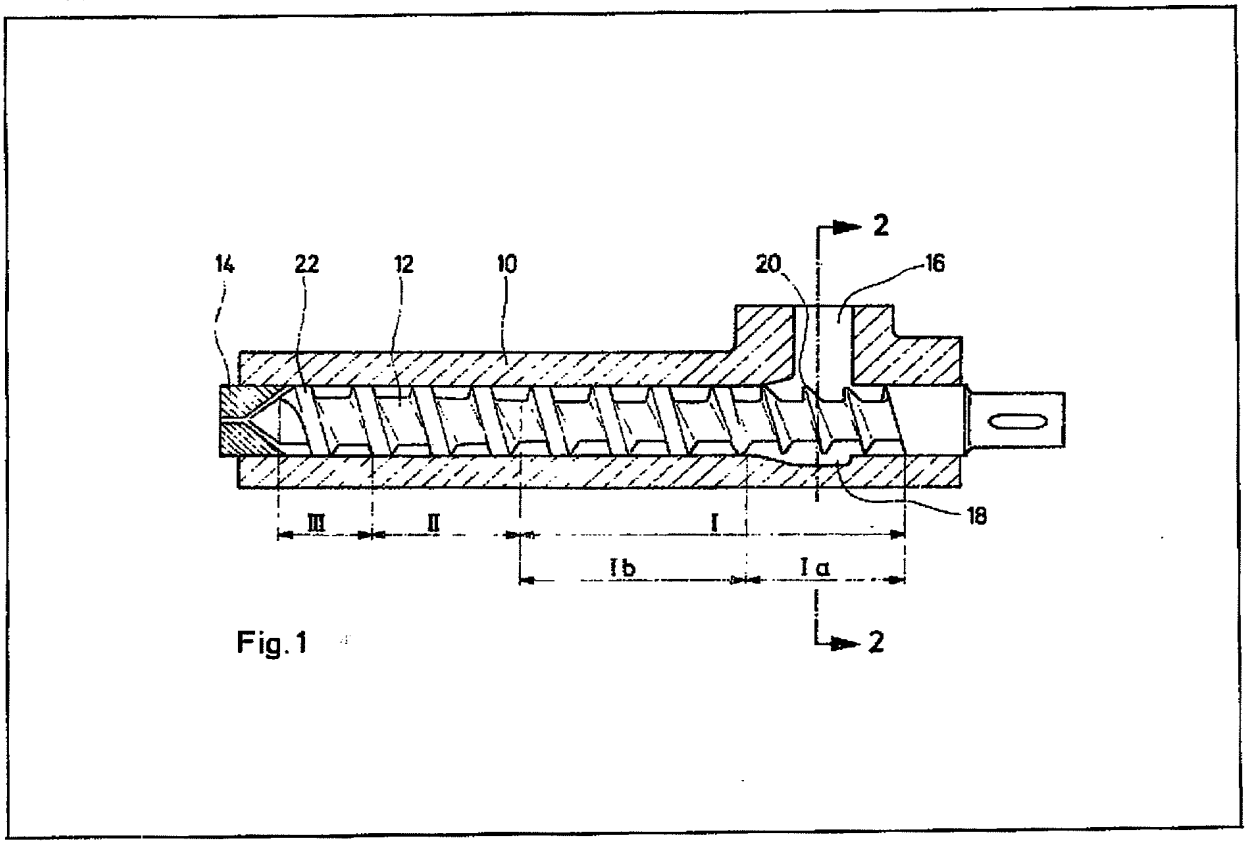


Fig.1

GB 2 001 898A

2001898

Fig.1

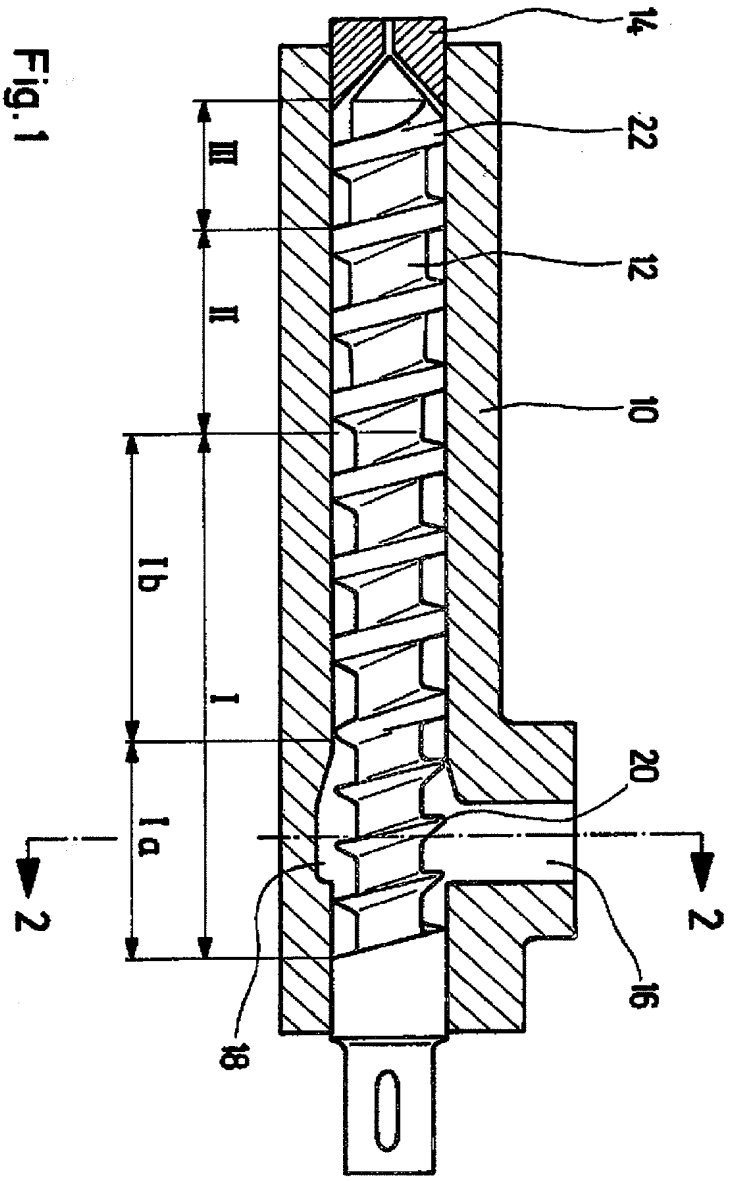
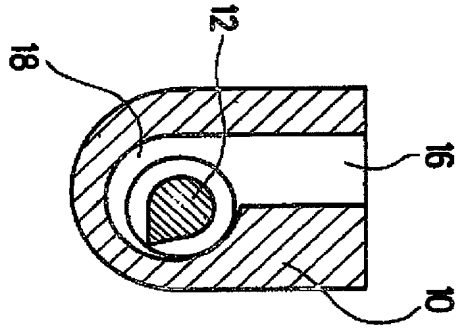


Fig. 2



2001898

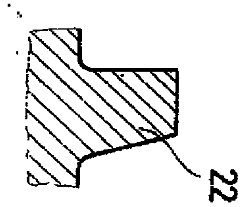


Fig. 3

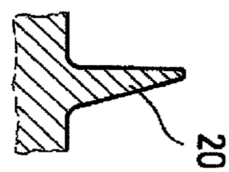


Fig. 4

Fig. 4a

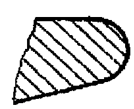


Fig. 4b

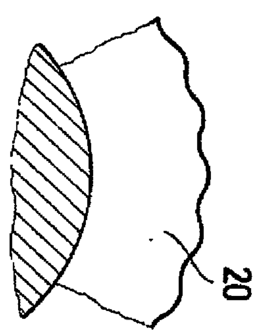


Fig. 5

SPECIFICATION

Plasticising machine for processing raw material in band form

The invention relates to a plasticising or injection moulding machine for the processing of bands of raw material and to a plasticising screw for such a machine.

Known plasticising or injection moulding machines have been developed for the processing of raw material in granular form. However, use of granular material has disadvantages. For example it necessitates an additional process step for granulating the material and some materials, e.g. soft rubber, tend to agglomerate when in granular form. Increasingly, plasticising machines are fed with raw material in the form of bands wound on drums or lying on pallets, though this is not what they were designed for.

Known plasticising machines usually comprise a plasticising cylinder having a central passage which extends in an axial direction, and into one end of which an inlet aperture opens. An Archimedian plasticising screw is rotatably mounted in the passage. The screw has a generally helical thread over most of its length the thread profile being flat-topped and wide. In operation, raw material is fed through the inlet aperture and conveyed by rotation of the screw to the other end of the passage where it is forced through an injection nozzle. In order to permit entry of raw material in band form, e.g. raw rubber, a specially-shaped inlet aperture is necessary. It has also been proposed to enlarge the passage adjacent the inlet aperture to provide an "inlet pocket" of greater diameter than the rest of the passage, the pocket narrowing in the material feed direction until it merges with the main passageway. In this way the friction which occurs when raw material in band form enters the passage and is pressed against the internal wall of the cylinder is somewhat reduced. However, even with such modifications, the rate at which material in band form can be fed into the injection moulding machine is much less than the rate obtainable with granular material.

The invention therefore has as an object to provide a plasticizing machine of improved infeed efficiency, and therefore plasticising efficiency.

We have now found by tests that the portion of the thread of the plasticising screw situated in the region of the inlet aperture has an important influence on the friction when bands are fed into the plasticising cylinder.

According to the invention there is provided a plasticising machine for the processing of raw material in band form, having a plasticising cylinder in which is defined a passage comprising an inlet zone into which an inlet aperture opens, a pressing zone and an expulsion zone, and an Archimedian plasticising screw rotatably mounted in said passage, the screw having a substantially triangular thread-profile in the region of the inlet aperture.

By "'substantially triangular" it is meant that the thread profile is much wider at the bottom than at the top or crest where it may be generally apical or comprises a relatively narrow land separated from the lateral walls of the thread by edges. The thread profile is such that there is an enhanced cutting-in effect when band material is fed in, so that the inlet friction is considerably reduced. However, it may be disadvantageous to have too much of a cutting-in effect which could occur for example if the thread profile were a triangle with a very small apical angle. It may be of particular advantage to provide a thread profile having a land with a plurality of edges closely spaced, and/or to round-off the edge or edges.

It is preferable, for efficiency of conveying material, to have a thread profile which is substantially an oblique triangle (i.e. not symmetrical about a perpendicular), preferably in conjunction with a crest whose height varies along its generally helical extent so that it has a corrugated or saw-tooth outline.

It has also been found that the friction between the bands and the wall at the inlet stage can be reduced further if the thread of the plasticising screw is made deeper in the region of the inlet aperture. The region of deep thread may extend some way along the screw beyond the immediate vicinity of the aperture (but there should still be shallower thread in the pressing and expulsion zones). The region of deep thread allows the newly introduced bands to escape into the thread between the crests away from the wall of the passage.

A preferred embodiment of the invention will now be described in detail by way of example with reference to the accompanying drawings, wherein:–

Figure 1 is a sectional view of a portion of a plasticising machine according to the invention,

Figure 2 is a section along the line 2–2 of Fig. 1,

Figure 3 shows the thread profile of the plasticising screw in the pressing or expulsion zone,

Figure 4 shows the thread profile in the region of the inlet aperture,

Figures 4a and 4b are fragmentary views on a larger scale than Fig. 4 illustrating two differently shaped thread crests, and

Figure 5 is an enlarged view of a portion of Fig. 2 showing a portion of a thread of the plasticising screw viewed in an axial direction.

A generally cylindrical passage 11 is defined in a plasticising cylinder 10 and a plasticising screw 12 is mounted therein so as to be axially slidable and rotatable by means

of a conventional drive (not shown) situated to the right of the plasticising cylinder 10 in Fig. 1. At the left hand side of Fig. 1 the passage 11 is almost closed by an injection nozzle 14 leading to a mould (not shown) into which plasticised material is to be injected. The mould can be conventional, and forms no part of the invention.

The passage 9 of the plasticising cylinder 10 can be regarded as comprising three zones: an inlet zone I; a pressing zone II; and an expulsion zone III. The inlet zone I can be subdivided into zones Ia and Ib, zone Ia being in the region of an inlet aperture 16 through which raw material in band form is introduced, and inlet zone Ib being between zones Ia and II. In zone Ia the passage 9 is formed as an inlet pocket 18 whose diameter is larger than the diameter of the passage 9 in the zones Ib, II and III, and which narrows conically towards zone Ib. As Fig. 2 shows, the inlet pocket 18 is eccentric relative to the plasticising screw 12 extending radially outward of it on the side into which the inlet aperture 16 opens. This aids the transport of raw material which is fed in through the inlet aperture 16 and forced by rotation of the plasticising screw 12 into a space between the plasticising screw 12 and the internal wall of the plasticising cylinder which narrows in cross-section because of the eccentricity of the inlet pocket. Thence the material is conveyed towards the pressing zone through the tapering region of the inlet pocket 18.

In zone Ia the thread 20 of the plasticising screw 12 has a pointed generally triangular profile (Fig. 4) in contrast with the profile of the thread 22 in the other zones (compare Fig. 3). The profile changes smoothly in an intermediate region between the zones Ib and Ia. Thus the thread 20 in the region of the aperture 16 is sharper than the thread 22 of the rest of the screw 12 which is flat topped and so there is a cutting-in of the raw material as it enters zone Ia, thus reducing the resistance.

Preferably the profile triangle is oblique. For example, the cross-section of the profile seen in Fig. 4 is a triangle sloping to the left. Figs. 4a and 4b show preferred forms of the crest of a generally triangular profile of the thread 20. The crest shown in Fig. 4a has two rounded right-angled edges which are situated closely adjacent one another and connect the flat land to two parallel walls. The crest of Fig. 4b has only a single rounded apical edge whose radius of curvature is about half as great as the width of the land shown in Fig. 4a.

Conventionally, the depth of the thread of a plasticising screw is constant along its helical length. Apparatus according to the present invention may have such a thread of constant height. Preferably, however, the crest of the thread 20 undulates (as shown in Fig. 5) or has another such varying outline, e.g. sawtooth. Such outlines aid the taking-in of the material in band form as the plasticising screw 12 rotates, and further reduces the friction.

As Fig. 1 also shows, in the preferred constructional form the minor diameter of the plasticising screw 12 (i.e. the diameter excluding thread) in the inlet zone 1 is smaller than in the pressing zone 2 and the expulsion zone 3, so that the trough between the turns of the thread is greater in the inlet zone. In order not to hinder the continuous feed of the material, the trough depth changes gradually and not suddenly. The greater thread depth in the inlet zone 1 provides greater space for accommodating material which has been newly fed in, and this can further reduce the friction.

CLAIMS

1. A plasticising machine for the processing of raw material in band form, having a plasticising cylinder in which is defined a passage comprising an inlet zone into which an inlet aperture opens, a pressing zone and an expulsion zone, and an Archimedian plasticising screw rotatably mounted in said passage, the screw having a substantially triangular thread-profile in the region of the inlet aperture.

2. A plasticising machine according to claim 1 wherein the crest of the thread in said region has a plurality of closely spaced edges.

3. A plasticising machine according to either one of the preceding claims wherein the or each edge of the radially outer limit is rounded.

4. A plasticising machine according to any one of the preceding claims wherein the height of the crest in said region fluctuates along its length.

5. A plasticising machine according to claim 4 wherein the crest in said region has a corrugated or saw tooth outline along its length.

6. A plasticising machine according to any one of the preceding claims wherein the thread is deeper in said region than in the rest of the screw.

7. A plasticising machine according to any one of the preceding claims wherein the passage in said region widens to define an inlet zone.

8 A plasticising machine according to any one of the preceding claims wherein the cross-section of the crest in the pressing and expulsion zones is broad with a flat land.

9. A plasticising machine substantially as described herein with reference to the accompanying drawings.

10. A plasticising screw according to the invention substantially as herein described.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.